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(54) Apparatus for simulating flames

(57) A heating appliance has an object, such as simulated fuel (3), positioned in front of a light diffusing and reflecting screen (4), which reflects an image of the object (3). A light source (7) directly illuminates strips of foil (9) on a rotor (8), whereby moving beams of light (B, C) are reflected from a rear reflector (6) onto a light diffusing surface (4b) of the screen (4). When the rotor rotates, moving beams of light appear like flickers moving upwardly on the screen (4). The source (7) is shielded (10). An auxiliary reflector (13) reflects moving beams along another path (D) to be viewed by a viewer nearer to the appliance. The appliance houses a fan heater (2).

The reflector (6) may be fixed or have a variable angle of inclination. The movement of the strips of foil may be intercepted to thereby accelerate the moving beams of light. A translucent panel (5) may be provided in front of object (3). This panel may be tinted, partially reflective or masked.

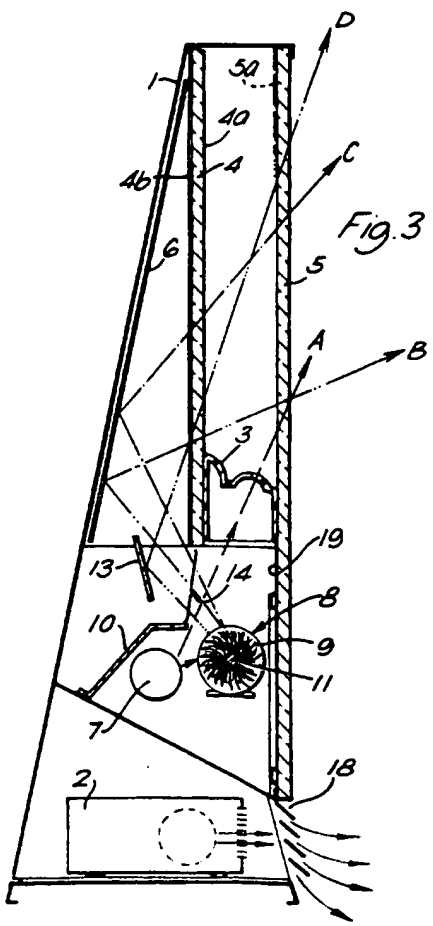

Fig.3

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Fig.1

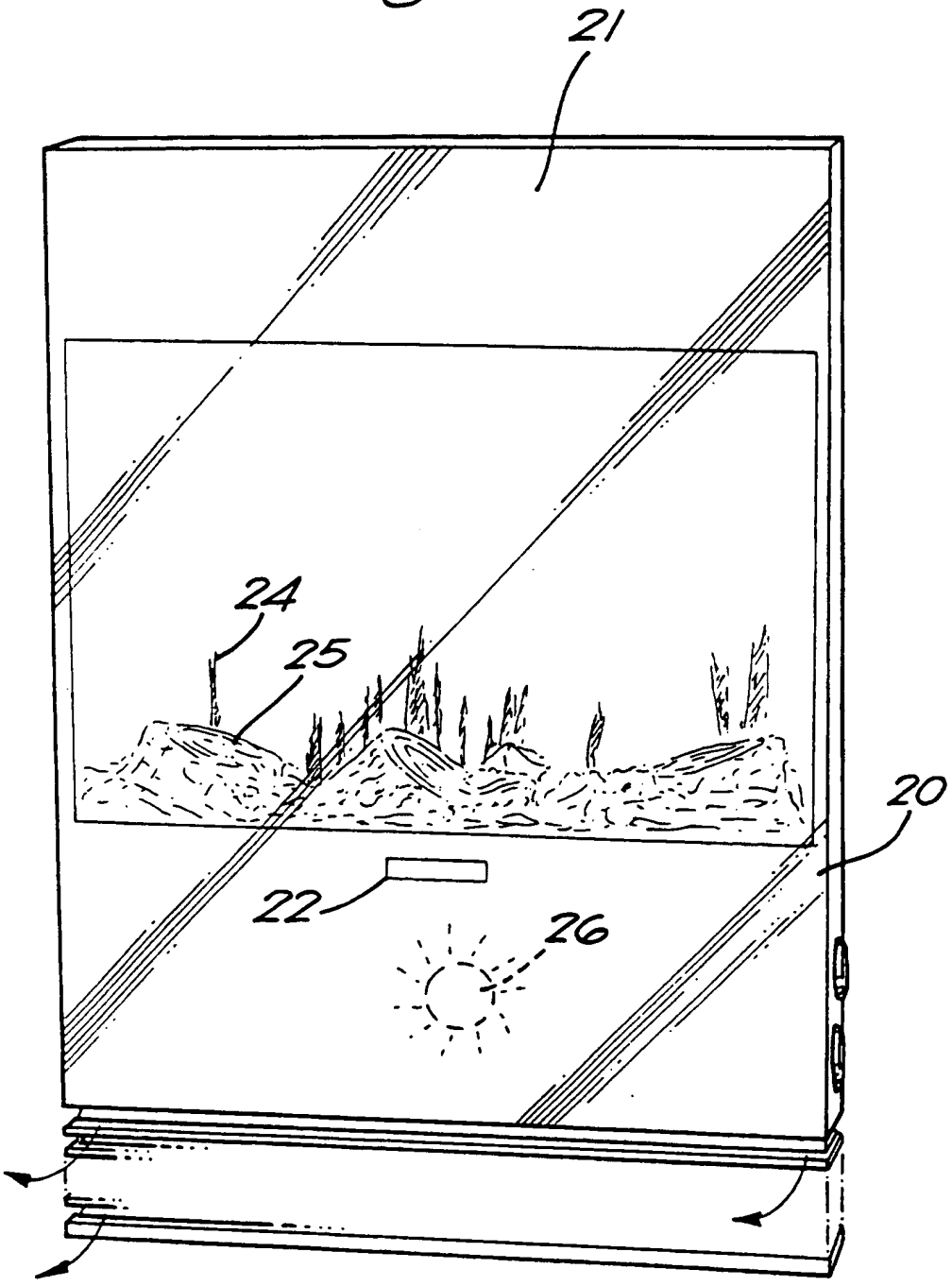


Fig. 2

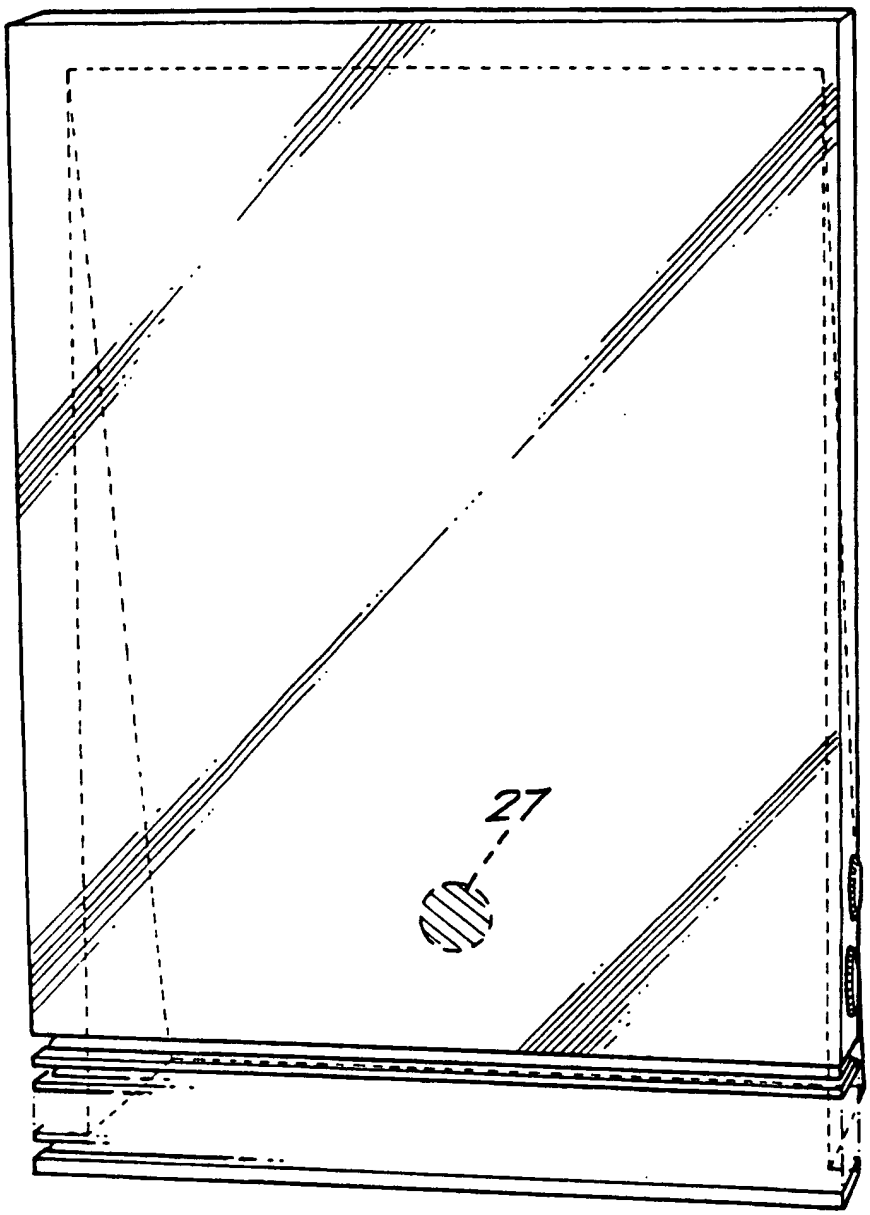


Fig.4

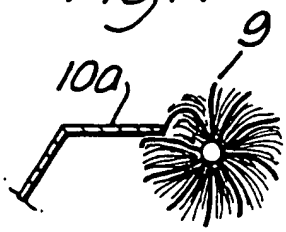


Fig.5

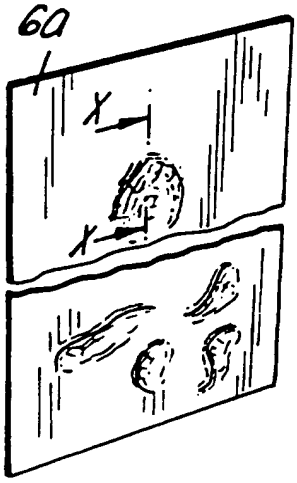


Fig.6

Fig.3

Fig.7

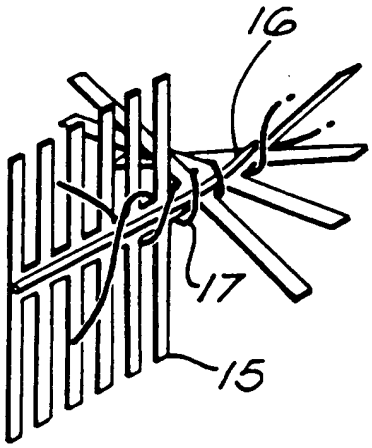


Fig.8

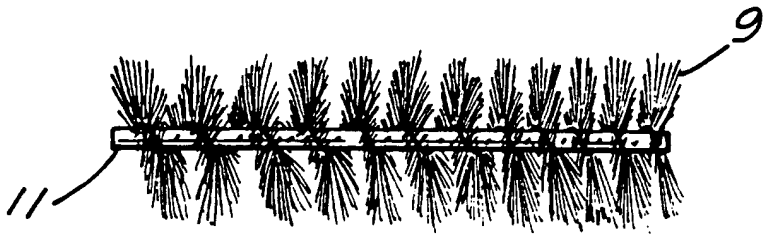
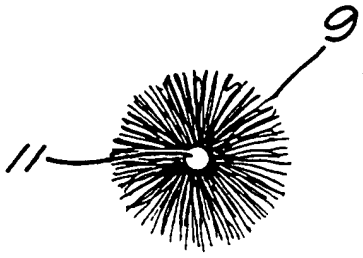


Fig.9



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APPARATUS FOR PRODUCING AN OPTICAL EFFECT

This invention relates to apparatus for producing an optical effect, for example, either for simulating flames, or for use as a decorative effect. The apparatus may be used, in particular (but not exclusively) in simulating a solid fuel fire. The apparatus may also be used on its own, purely as a decorative effect. If it is part of a heating appliance, this may not necessarily be a fire, but any other appliance which loses heat by radiation or convection.

GB-B-2 230 335 and GB-A-2 275 105 each disclose examples of apparatus for simulating a solid fuel fire in which ribbons or a flag are used to simulate flames. A fan is used to create an air stream in which the ribbons or flag flutter. Light, reflected from the ribbons or flag, falls onto a light diffusing screen and creates the impression of flames. The screen is also capable of reflecting light from simulated fuel positioned in front of the screen, so that simulated flames appear to emanate from between the simulated fuel and its reflected image in the screen. Such means can be used to create a particularly effective and realistic simulation of a solid fuel fire. Although the effect is particularly good, it would be advantageous to dispense with ribbons and a fan, if this could be achieved without significantly affecting the realism. Therefore, a problem to be solved, by at least the preferred embodiment of the invention, is to produce a visually acceptable simulated fire effect without using the ribbons or flag and the fan.

GB-B-2 180 927 discloses the use of first and second reflective means for providing front-to back multiple images.

According to the invention, apparatus for producing an optical effect comprises means for producing moving beams of

light; screen means capable of diffusely transmitting light and of reflecting an image of an object positioned before the front of the screen means, whereby a reflection of the object can be seen in the screen means; and light reflecting means, which are arranged relative to the means for producing moving beams of light and to the screen means, so that the beams of light are reflected onto the screen means.

The means for producing moving beams of light may include a light source, such as a lamp or lamps, which directly illuminates pieces of reflective material, such as reflective foil, mounted on a rotor, so that a multiplicity of reflecting surfaces are sequentially presented to the light source as they rotate. In one arrangement, metal foil strips extend radially from a strand which is wrapped around a shaft that is rotated by an electric motor. Such material may have the appearance of, for example, tinsel used in Christmas decorations, or a cylindrical brush having foil strips instead of bristles. Strips of foil may be secured by a twisted wire which tends to twist the foil strips into a spiral of radial arms. Such foil may be silver, but it is preferably also tinted with different colours which are selected so as to introduce the required amount and the hue of the colour required into the beams of light (e.g. to simulate flames). Alternatively, a rotating bowl, or rotating vanes, may be used to produce the same effect, using coloured reflectors, and/or coloured lamps or filters as may be required.

The reflecting means is preferably arranged behind the screen means so as to receive light reflected from pieces of rotating reflecting material (such as foil strips on a rotor) and to reflect it onto the rear of the screen means. For example, a reflecting panel, which can be made of a metal or foil, can be positioned behind the screen means and arranged so as to reflect the beams of light in such a way that flickers appear to travel upwardly on the screen means.

In one arrangement, the reflecting panel is inclined with respect to the plane of the screen means so as to reflect the beams of light onto a desired zone. In the case where the object is simulated fuel and the apparatus is used to simulate a fire, this zone occurs where flames would be expected to be seen from a given viewing position in front of the screen means. For example, if a user were sitting in front of the fire, the viewpoint would be lower than that of someone standing near the fire (who would have a steeper viewing angle). The reflecting panel, and/or another reflector may be adapted so as to cause the beams of light to be reflected on more than one zone of the screen means, whereby a person sitting in front of the fire will see flames immediately above what appears to be glowing fuel (i.e. where the object is simulated fuel), and a person standing near the fire will also see flames immediately above the glowing fuel, although they would each see different reflections. The additional reflector could be a small prism or another reflecting panel arranged so as to deflect some of the light beams into an alternative zone.

When the reflecting panel is a thin reflective sheet, it is preferably deformed in some way so as to break up the light beams in a random fashion. This may be simply achieved by causing the reflecting surface to be folded or wrinkled, or even broken. For example, an effect similar to that achieved by crinkling a sheet of paper, will create wrinkles in the reflective sheet and this will cause the beams of light to be reflected or scattered at different angles. A sheet of cracked or broken glass would have a generally similar, but slightly different effect. Alternatively, regular deformations, such as corrugations, or bumps, could be used. The reflecting panel may also have a flamed shaped reflecting region, or a region having an irregular upper edge, the remainder being darker or black. It would also be possible to use a white reflector to provide a diffuse reflection of light, instead of using a more polished reflector which tends to give sharper

reflections. The reflecting panel could also be concave or convex, and/or cylindrical about either a vertical, or horizontal axis. Combinations of these different features may also be used. The reflecting panel would normally be fixed, but its angle of inclination could be made adjustable so that it could be set or "tuned", by a factory, to achieve the required effect (i.e. especially where different models are manufactured having, for example, either or log or coal effects).

The light source, which preferably comprises a strip lamp or one or more bulbs, may be arranged to illuminate directly the pieces of reflective material so as to produce beams of light that pass through a gap before falling onto the reflecting means (where it is then reflected onto the screen means). Such an arrangement allows much of the light radiated from the source to be received by the reflective material (e.g. foil) and then to be re-directed towards the screen means. The size of the gap may be selected, or possibly made adjustable (for factory use), so that beams of light having the required appearance are reflected onto the screen means. This is important when seeking to obtain realism in simulating a solid fuel fire. When the gap is closed, this clearly cuts off the beams of light, and as the gap is opened, more beams pass through, which tends to increase their apparent brightness. The gap size may be selected or varied, with regard to the angle of inclination of the reflecting panel, to obtain the best effect.

Light shield means may be provided to prevent at least most of the light from the source from falling directly onto the rear of the screen means. For example, an independent shield may be positioned adjacent the light source and arranged to prevent its light from falling directly onto the rear of the screen means. This helps to keep the screen means comparatively dark, or in shadow, whereby the beams of light reflected onto the rear of the screen means appear to be brighter by comparison. Moreover, if the upper part of

the screen means is kept dark, this tends to simulate a dark background in a solid fuel fire which produces flames directly over combusting fuel and occasionally passing upwardly to a chimney opening. The light source and rotating pieces of reflecting material are preferably situated below the screen, the motion of the beams and the reflection being such that the reflected beams of light travel upwardly and fade away as they approach darker upper parts of the screen means. Where the screen means comprises, for example, a sheet of glass, the shield means may also prevent the lower edge of the sheet from being illuminated and from appearing, in the effect, as an unwanted bright strip. The shield means may have some small apertures to bleed some light onto the rear reflecting panel.

Where strips of foil are mounted on a rotor, some of these strips may be caused to strike an obstruction as the rotor rotates, so as to introduce a sudden flicking motion. This causes a beam of light to travel rapidly across the screen means. In the case where the object is simulated fuel and the beams of light represent flames, this gives the impression of shooting flames, or sparks, thereby adding to realism.

In designing and manufacturing heating appliances, consideration needs to be given to customers who prefer a more modern effect, as well as to those who prefer the traditional appearance of a solid fuel fire. Thus, it may not always be the intention to achieve realism in simulating a solid fuel fire, but to design the optical effect more by way of a decorative feature. For example, in our GB-B-2 180 927, an effect is disclosed for creating the impression of a deep fuel bed in an apparently slim fire. Such a fuel bed may not be considered by some to be realistic, i.e. in the sense of burning coal, but an optical effect in which, for example, a multiplicity of transparent or translucent pieces of glass, possibly coloured, can be brightly

illuminated (e.g. from beneath), thereby providing multiple reflections, which are readily perceived by a user, to create the effect of a deep but fading bed of light. This may not represent a burning fire, but it is still attractive. Alternatively, if the aim is to create a realistic burning fire effect, the fuel (e.g. coal or logs) is faithfully reproduced and simulated flames are made to appear in the correct place, with the correct colour, and having the correct movement. Clearly, there may also be a market for optical effects between these extremes. The invention facilitates the manufacture of appliances having different designs at lower manufacturing costs.

The invention may be embodied in a design of a heating appliance having the same outer casing, most of the same means for simulating the required optical effect, and, for example, the same fan convector heater. Then, the means for simulating fuel and the reflecting panels and/or screens used can be easily changed so that different models can be readily assembled to suit customer requirements. This enables fires to be more readily constructed to meet consumer demand.

An embodiment of the invention will now be described with reference to the accompanying schematic drawings, in which:

Figs. 1 and 2 are front elevations of a heating appliance, embodying the invention, with an optical effect switched on and off respectively;

Fig. 3 is a side elevation, in section, of the heating appliance;

Fig. 4 shows a detail of a modification;

Figs. 5 and 6 are perspective and sectional views of part of a reflecting panel with deformations;

Fig. 7 shows an enlarged detail of the foil strips;

Fig. 8 shows a detail, in perspective, of strips of metal foil mounted on a rotor; and

Fig. 9 shows an end-on view of the rotor.

Referring to Figs. 1-3, a heating appliance has an outer casing 1 which contains a fan heater 2 and means for producing an optical effect. The latter means include simulated fuel 3 positioned between two glass screens 4 and 5, a reflecting panel 6 inclined with respect to screen 4, a light source 7 and a rotor 8 on which is mounted a multiplicity of radially extending reflecting foil strips 9. A shield 10 prevents light from source 7 from falling directly onto the rear surface of screen 4.

A front surface 4a of screen 4 preferably has a high quality thin reflective coating which acts like a transparent mirror. Therefore, a reflection of the fuel 3 can be perceived in screen 4 when viewed from the front of the appliance. Alternatively, instead of applying a reflective coating to the glass panel 4, a tinted panel may be used to give a reflection of the fuel. Such a reflection, like a dark mirror, will not be as strong as the reflection obtained with a reflective coating, but it may be adequate.

The rear surface 4b of screen 4 is treated so as to act as a light diffuser. For example, it may be shot-blasted, silk-screened, etched, abraded, or coated with material which diffuses light. Alternatively, a separate sheet, acting as a light diffuser, may be used with a glass panel 4. This causes beams of light to be made visible to a user on the screen.

The glass panel 4 may alternatively have a reflective coating on its rear surface (since this would be visible

through transparent glass), but it is preferred to make the front surface reflective, because the fuel 3 can then made to touch its reflection and no gap appears between the fuel 3 and its reflected image.

The simulated fuel is shown in the drawing as a plastics moulding which simulates halves of logs. A reflection in the screen "completes" the logs which then appear whole when viewed by the user. Instead of using imitation logs, pieces of transparent or translucent glass may be used, or imitation coal, or any other object for simulating glowing fuel or the required optical effect. The underside of the simulated fuel 3 is open to the space beneath and hence the simulated fuel moulding receives light from source 7. This causes it to be illuminated, in use (as shown by arrow A) and to have the appearance of (e.g.) glowing embers or coal. The light from source 7 also falls directly onto the multiplicity of foil strips 9 which are mounted on a rotating shaft 11 driven by a small electric motor (not shown). The kind of mechanism employed may be similar to a rotisserie normally used on an oven. The foil strips are normally silver in colour, but preferably include other colours, for example, mainly yellow, a little red and a very small amount of blue, which helps simulate the colour of flames. We have found the kind of tinsel decoration used for Christmas garlands, i.e. for decorating picture frames and trees, is suitable for use in the preferred embodiment of the invention. However, wider foil strands would be better than those found in the usual kind of tinsel. As these strips rotate, they reflect beams of light, onto reflecting panel 6 where they are, in turn, reflected onto the rear of screen 4 on which they are visible. These beams are represented schematically in Fig. 3 by arrows B and C. The arrangement is such that as any particular strip rotates, the angle of reflection changes and the beam travels up the surface of the reflecting panel 6, for example, between the beam paths B and C shown in Fig. 3. This simulates the effect of flames moving upwardly on the

screen 4 and fading away into the darker upper regions of screen 4. These upper regions are preferably kept in shadow, or are darkened, due to the arrangement of the light source, reflecting surfaces, and shields. The beams B and C, representing a flame moving upwardly from fuel 3, may be perceived by a user sitting in front of the appliance. However, someone standing nearer to the appliance and having a steeper viewing angle, may not see them. An auxiliary reflector 13 may therefore be positioned so as to receive beams of light from the foil strips 9 and to reflect the beams at a steeper angle onto screen 4 so that they may be perceived by a user standing near the fire. A typical beam is schematically indicated by the arrow D. Although the beams of light are diffused by screen 4, they are shown as straight beams B, C and D in Fig. 3 to simplify the drawing.

The light beams from the foil rotor (8,9) pass through a gap 14 between shield 10 and the lower edge of screen 4. The dimensions of this gap may be selected, or adjusted (by masks not shown) so as to allow the correct amount of light to fall onto the reflecting panel 6 to create the desired effect. Moreover, the angle of inclination of reflecting panel 6 (and auxiliary reflector 13 if used) are carefully chosen so that (with the correct direction of rotation of rotor 8) the beams of light appear to rise from between the fuel 3 and its reflected image in screen 4 and pass upwardly on screen 4 into darkened upper regions. Clearly a balance may need to be struck between the level of illumination of source 7, the density and disposition of foil strips 9, the size of the gap 14 and the inclination and reflectivity of reflecting panel 6, so as to create an optimum effect.

The reflecting panel 6 may be highly reflective, or made of foil, or galvanised material, or it may be white (to produce a diffusing effect) or coloured (either over its entire surface, or have various colours in different regions). The panel 6 can be made of metal or plastics and it may be deformed in some way to create a more random

effect of the beams on screen 4. For example, a thin aluminium or metallised plastics film 6a can be distorted by pressing an object against a sheet of this material, or even standing on it, so as to produce irregular bumps, folds or crinkles, as shown in Fig. 5 and the section on XX in Fig. 6, and these have the effect of scattering or reflecting light along other paths. However, a more regular pattern of deformation may be used to produce other effects. For example, the reflecting panel may be corrugated or have a series of regular bumps or depressions thereon. A further effect can be achieved by using a broken or cracked sheet of glass, with a reflective backing, which has the effect of scattering or randomly reflecting light at the cracks or break lines. The panel 6 may also be slightly cylindrical, either curved about a horizontal, or a vertical axis, in order to improve the effect. In a further modification, the panel 6 has flame shaped reflective regions and darker regions which are arranged in a pattern to create the effect required.

As shown in Figs. 7, 8 and 9, the rotor on which the foil strips are mounted is preferably just a shaft 11 on which the tinsel or foil is wound so that a multiplicity of strips project radially outwardly. Fig. 7 shows one technique for attaching foil strips shaped like a comb 15 to a string core 16 by twisted wire 17. Fig. 4 shows a modification where a portion 10a of the shield 10 extends towards a section of the foil strips 9. The ends of the strips in this section then collide with the projecting part of shield 10, which causes them to flick over suddenly in order to produce a very rapidly moving beam of light. This can be used to simulate sparks in the flames.

Instead of using foil strips, a rotating faceted mirror could be used (i.e. similar to the kind of effect which was produced in ballrooms by a rotating bowl having an outer surface formed by a multiplicity of mirror facets which were illuminated by a spotlight). Other means may also be used,

including conventional spinner wheels, although these may not produce enough reflected light to make the optical effect worthwhile. One of the advantages of the arrangement shown is that a large amount of light falls directly on a multiplicity of foil strips and is then reflected through the gap 14 onto the reflecting panel 6.

Although the shield 10 prevents most light from reaching the rear of screen 4, it could have selective apertures (not shown) which shine some light directly onto the reflecting panel 6, or the back of the screen 4.

The front panel or screen 5 is preferably made from tinted glass so that when the light source 7 is switched off the appliance appears only as a dark object, i.e. without the interior (simulated fuel 3 etc.) being visible. The rear surface of panel 5 may optionally have a high quality thin reflective coating 5a in order to improve a multiple image effect. This is especially useful where lumps of transparent or translucent glass are used instead of the imitation log moulding, as these lumps of glass are more highly illuminated by source 7 and can be seen in more multiple reflections. This has the effect of a deeply extending bed of light which produces a decorative effect, rather than a traditional fire effect.

The front glass panel 4 preferably extends down below the level of the imitation fuel 3 to just above an outlet grille 18 through which hot air exits from fan heater 2. This gives the front of the appliance a very smooth clean finish, especially when the panel is made from darkly tinted glass. The lower part of this panel, i.e. from about the level of the imitation fuel 3 downwardly, may be masked by an opaque sheet 19 which makes the bottom portion 20 (Fig. 1) of the front of the appliance appear to be like polished jet (black). An upper portion 21 may be similarly treated. However, a small an area 22 (shown in Fig. 1) which may be in the shape of the manufacturers' Trade Mark or logo, is

not masked and this area then glows, due to illumination from source 7, when the appliance is switched on. Fig. 1 attempts to show the effect 23 switched on i.e. where flames 24 flicker above the middle of logs 25, the symbol 26 representing only that light source 7 if illuminated. Fig. 2 shows the plain appearance of the appliance when the light source 7 is switched off, the symbol 27 representing only that the light is off. These symbols are only indicative of the states in question and are not present on the appliances.

CLAIMS:

1. Apparatus for producing an optical effect, the apparatus comprising means for producing moving beams of light; screen means capable of diffusely transmitting light and of reflecting an image of an object positioned before the front of the screen means, whereby a reflection of the object can be seen in the screen means; and light reflecting means, which are arranged relative to the means for producing moving beams of light and to the screen means, so that the beams of light are reflected onto the screen means.

2. Apparatus according to Claim 1, in which the reflecting means is arranged behind the screen means so as to receive said moving beams of light and to reflect them onto the rear of the screen means.

3. Apparatus according to Claim 2, in which the reflecting means is inclined with respect to the plane of the screen means so as to reflect the beams of light onto a desired zone.

4. Apparatus according to Claim 3, in which the reflecting means and/or an auxiliary reflector is adapted to cause the beams of light to be reflected on more than zone of the screen means, whereby respective viewers of the effect, having different viewpoints, see different reflections on the screen means.

5. Apparatus according to any of the preceding Claims, in which the reflecting means is a panel or panels, having deformations which break up the light beams in a random fashion.

6. Apparatus according to any of the preceding Claims, in which the reflecting means is a panel which is either fixed, or has a variable angle of inclination.

7. Apparatus according to any of the preceding Claims, in which the light source comprises a lamp or lamps arranged to illuminate directly pieces of reflective material which are moved in order to produce the moving beams of light.

8. Apparatus according to Claim 7, in which the pieces of reflective material are foil strips having either the same, or different colours.

9. Apparatus according to Claim 8, in which the foil strips are mounted on a shaft extending substantially in the same plane as the screen means, the shaft being connected to drive means for rotating the shaft.

10. Apparatus according to any of the preceding Claims, in which light shield means are provided to prevent at least most of the light from said source from falling directly onto the rear of the screen means.

11. Apparatus according to Claim 10, in which the shield means assists in keeping upper portions of the screen comparatively dark, or in shadow.

12. Apparatus according to Claim 7, 8 or 9, in which means are provided to intercept at least some of the pieces of reflective material, during their motion, so as to cause them to move suddenly and thereby accelerate movement of the moving beams of light as seen on said screen means.

13. Apparatus according to any of the preceding Claims, in which the moving beams of light are directed through a gap, the size of which is adjusted, or is adjustable, so as to control the illumination of the screen means by the moving beams.

14. Apparatus according to any of the preceding Claims, including a translucent panel positioned in front of the object.

15. Apparatus according to Claim 14, in which the translucent panel is tinted, thereby enabling the optical effect to be viewed when the light source is switched on, but presenting a plain finish, obscuring the optical effect, when the light source is switched off.

16. Apparatus according to either Claim 14 or 15, in which the translucent panel is partially reflective and is arranged to cooperate with said screen means in order to produce visible multiple images of the object in the optical effect.

17. Apparatus according to any of Claims 14-16, in which the translucent panel is masked, except for one or more areas which transmit light, from the light source,so that said means are illuminated when the optical effect is switched on.

Patents Act 1977 -16- Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9502867.6
Relevant Technical Fields (i) UK Cl (Ed.N) F4W (W57); G5C (CDBF) (ii) Int Cl (Ed.6) F24C; G09F	Search Examiner R A H CASLING Date of completion of Search 5 MAY 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-17

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 1024047	(FROST)	1 at least
A	GB 975009	(FROST)	1 at least

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